Understanding the Shadowing Effects of the z-axis and 4π Calibration Systems

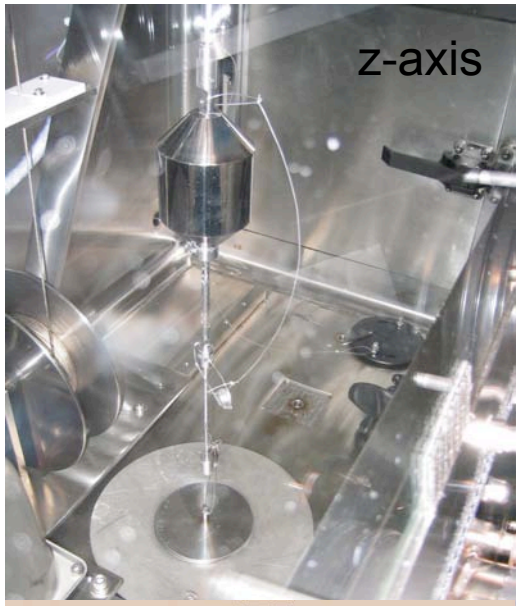
Source Shadowing Effects of the Deployment System

Status:

- Unknown systematic effect in the z-axis system, and in the analysis of z-axis calibration data!

- Shadowing effect *presumably* small.

- Not yet modeled in simulations.

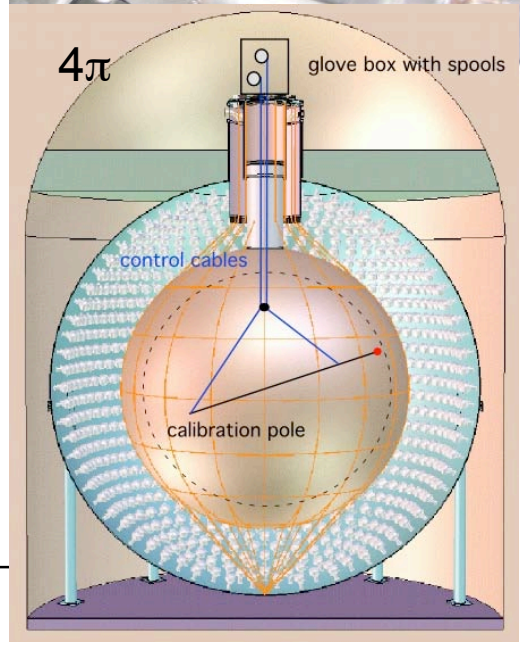


Question:

- What is the shadowing effect of the 4pi system?

- How do we compare data taken with the 4pi and z-axis systems?

- Can we correct for the shadowing effect in different deployment systems?

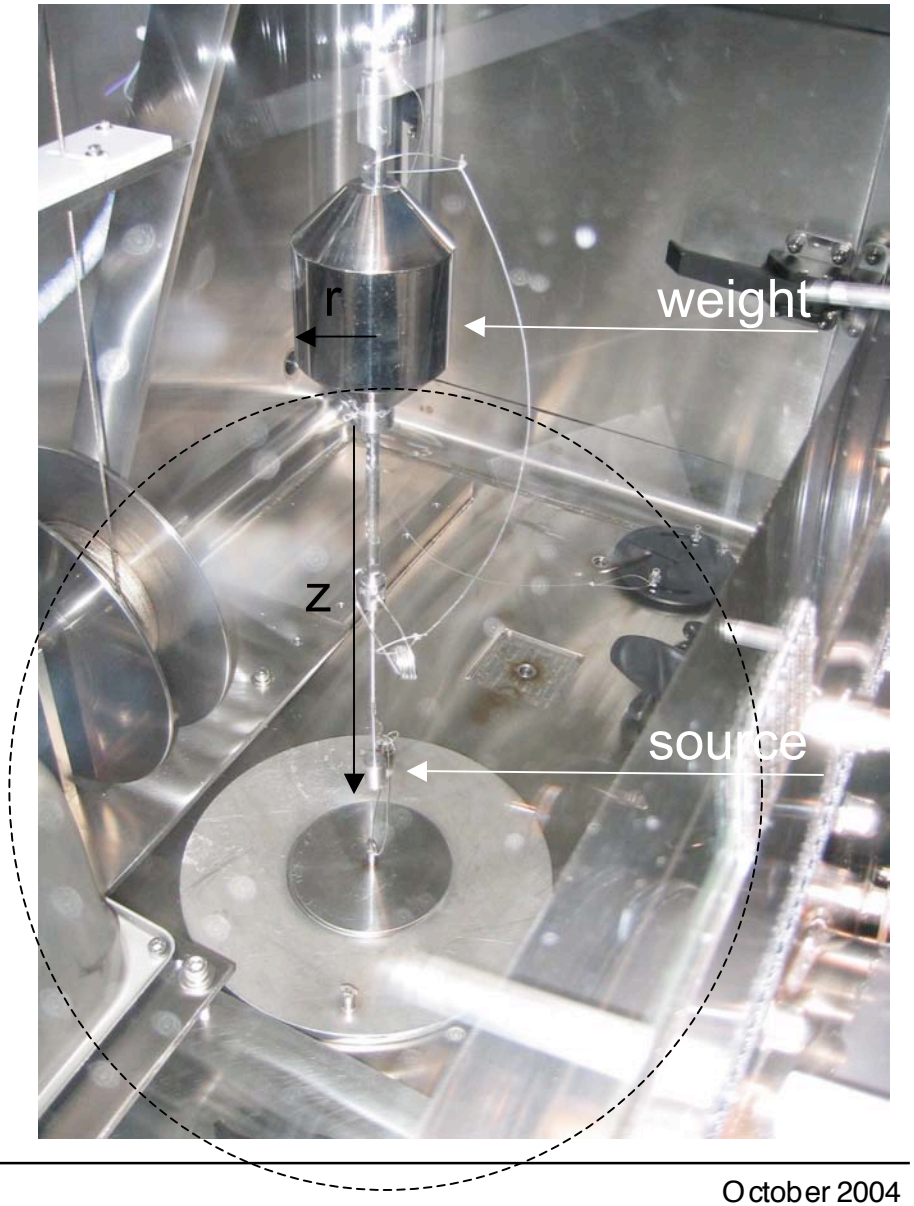


Present z-axis System

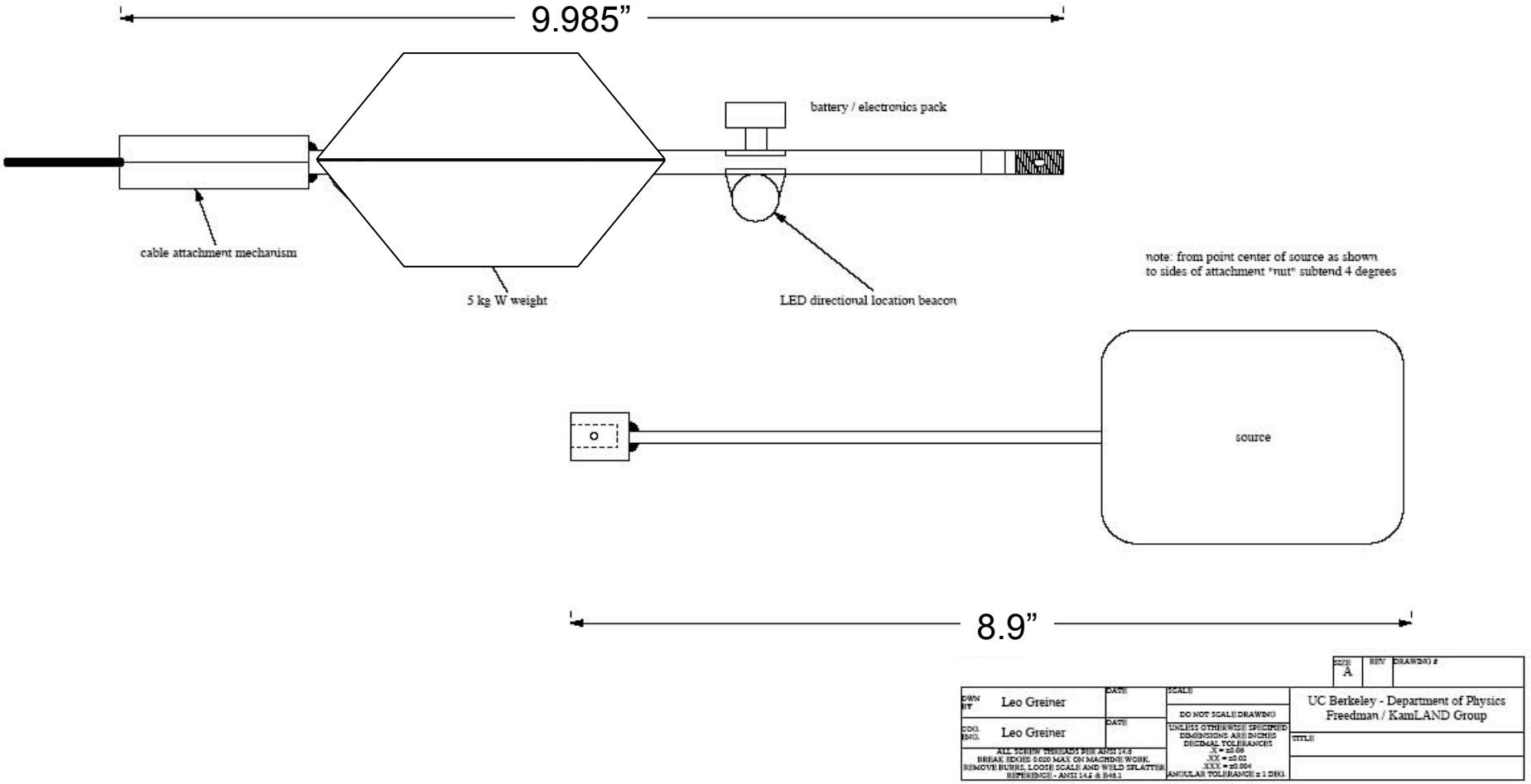
→ calculate geometrical shadow of z-axis weight to estimate relative size of possible shadowing effects

geometrical shadow of present z-axis weight ~0.03

Note: Obviously, ….γ and n do NOT see geometrical shadow



Source Attachment of Present Z-axis System



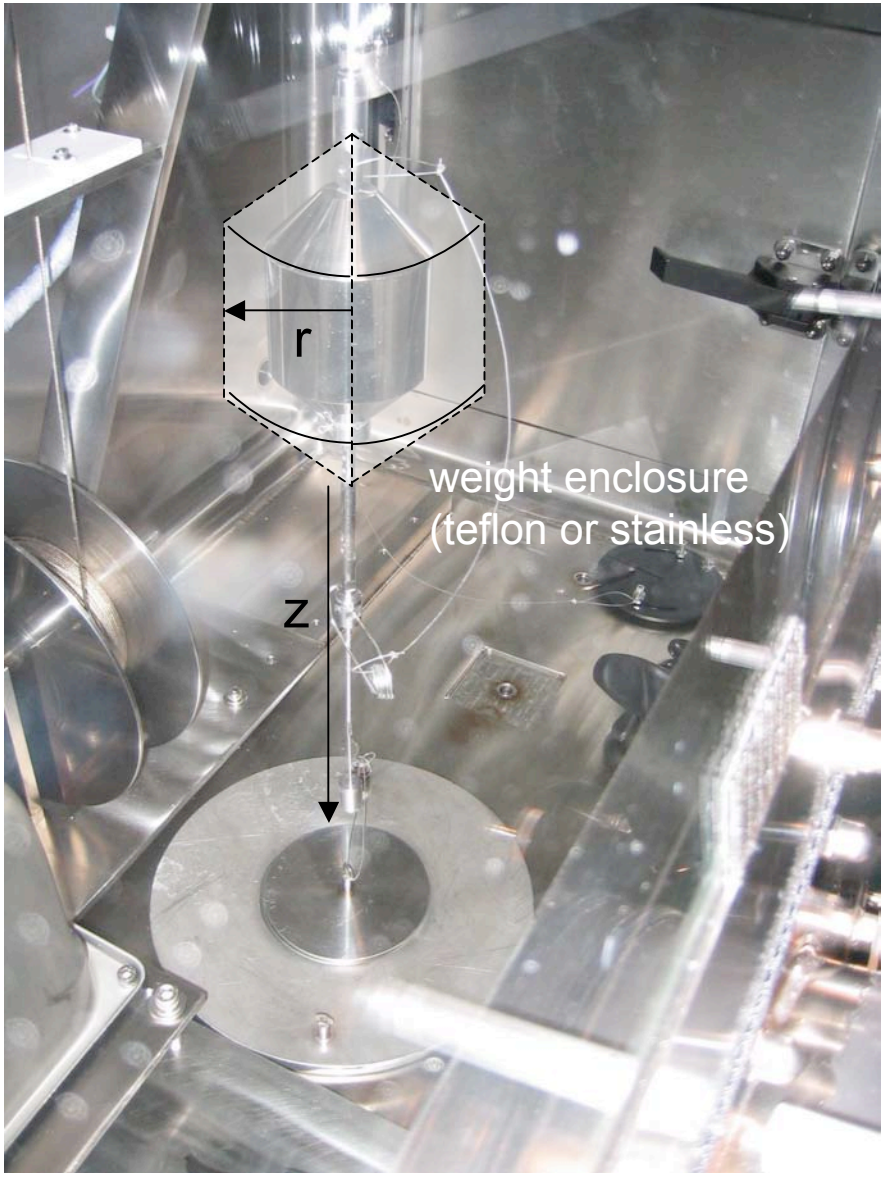
Z-axis System with Extra Shadow

geometrical shadow of present z-axis weight ~0.03

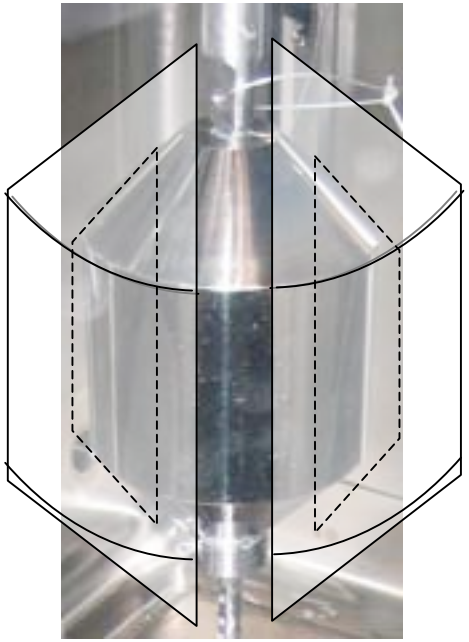
With enlarged z-axis weight of radius r at distance z we can test geometric shadowing:

r	z	Fractional Shadow $\pi r^2/4\pi z^2$
1.25	12	0.003 (present)
2”	10	0.01
2.5”	10	0.015
2.5”	8	0.025

weight enclosure:
- mounts in same position as z-axis weight
- compatible with LS (teflon or stainless)
- same shape → scales shadowing effect



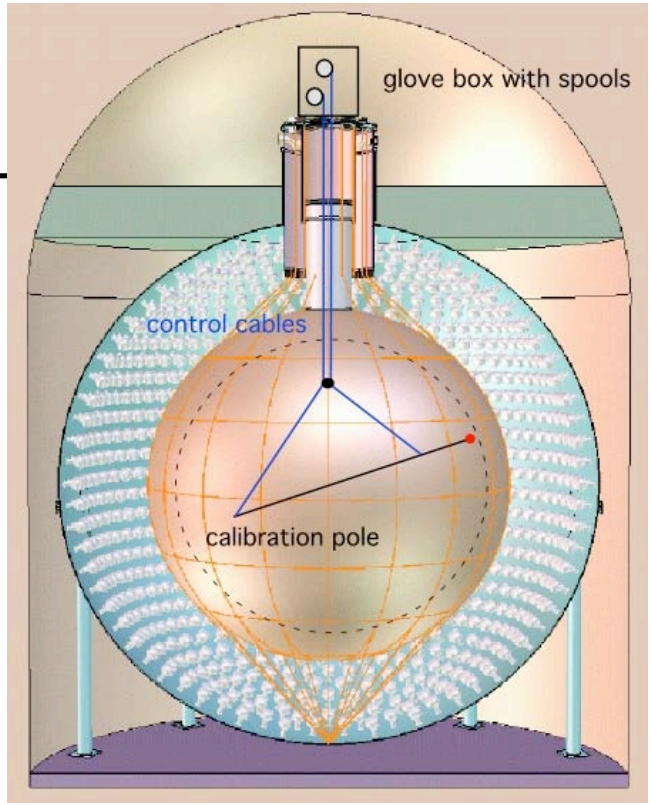
Enclosure for z-axis Weight



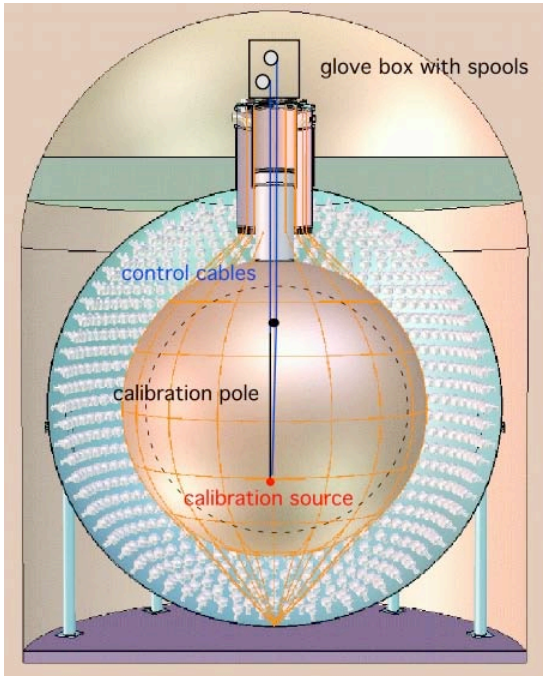
- same geometry as z-axis weight
- made out of stainless steel or teflon
- made out of two halves that fit over existing weight

4π Full-Volume Calibration System

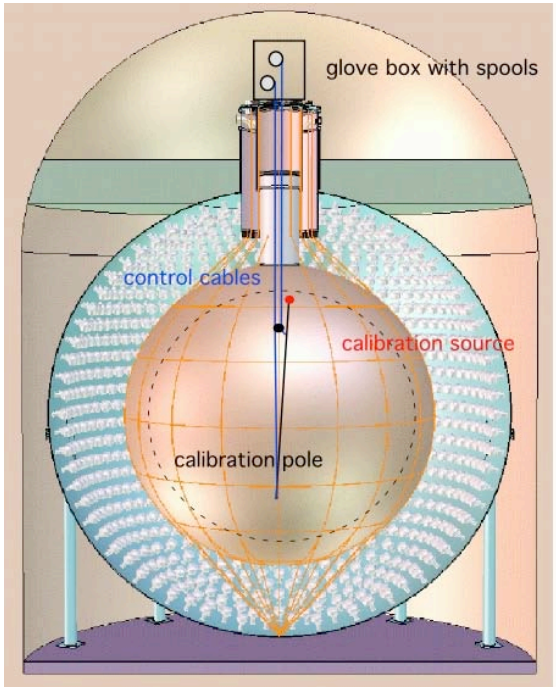
- Position dependent shadowing
- Calculate geometric shadowing effect



Minimum Shadowing

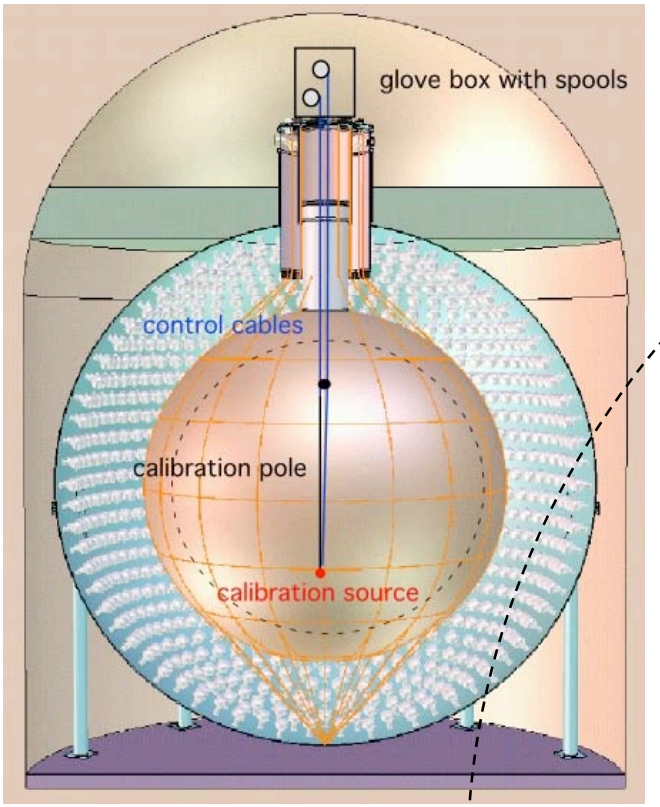


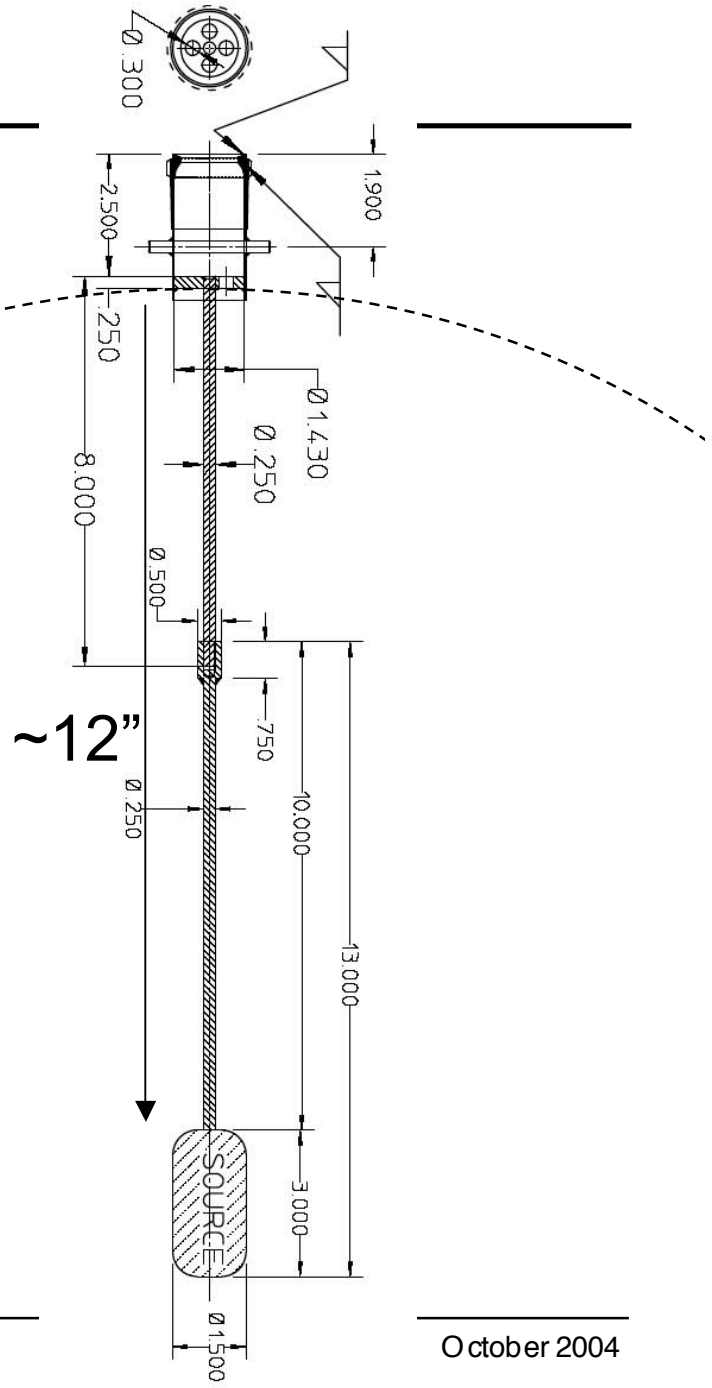
Maximum Shadowing



Shadowing Effects with the 4π System

Minimum Shadowing

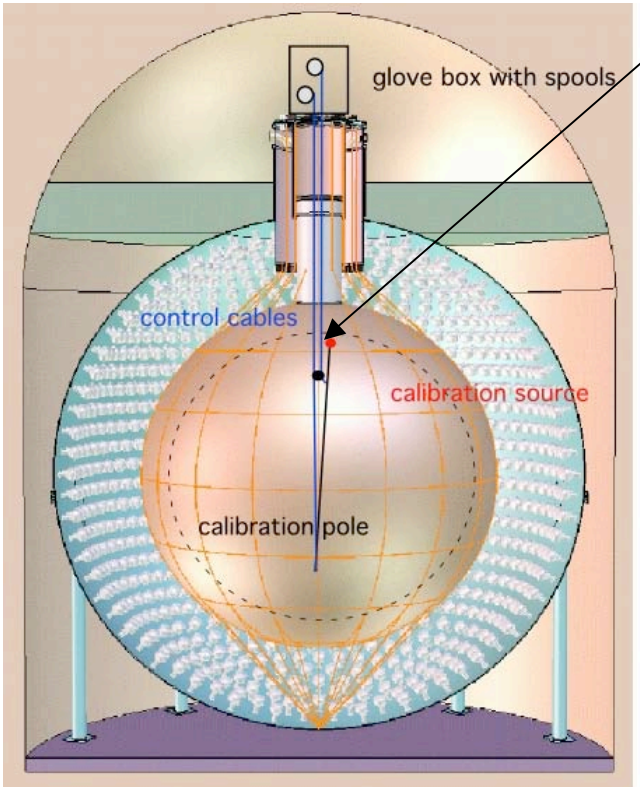




geometrical shadow of calibration pole diameter = ~0.1%

Shadowing Effects with the 4π System

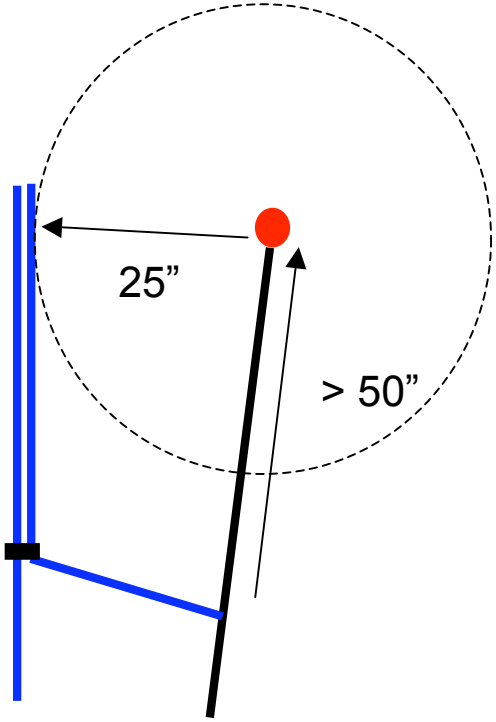
Maximum Shadowing



We make the following assumptions:

1. Calibration source never closer than 25” to vertical control cable.
2. Control cable attachment and source separated by one pole segment (>50”).

Shadow corresponds to 1”-wide band in 4π hemisphere of R ~25”



geometrical shadow estimate of control cables and calibration pole ~1%

Potential Problems and Issues with this Study

Monte Carlo Simulations:
- has to get materials and reflectivity right …

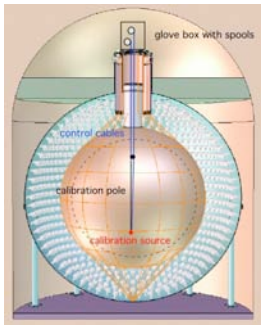
Summary

With enlarged z-axis weight of radius r at distance z we can test geometric shadowing:

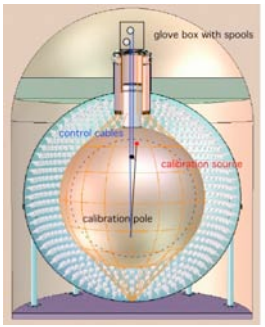
r	z	**Fractional Geometric Shadow**
1.25	12	0.003 (present system)
2”	10	0.01
2.5”	10	0.015
2.5”	8	0.025

The geometric shadowing effects we expect from the 4pi system are:

downard pole	0.001 (minimum)
upward pole	0.01 (maximum



min



max